40 may redirect a portion of light **56** onto image sensor **228** (e.g., as shown by beam **224** of FIG. **18**).

[0097] At step **254**, image sensor **228** may gather image data in response to beam **224** from multi-layer holographic combiner **40**. Image sensor **228** may convey the image data to control circuitry **16** over control path **230** (FIG. **18**).

[0098] At step **256**, control circuitry **16** may process the image data to determine whether display module **20**A needs to be adjusted to compensate for changes in the relative position between combiner **40** and display module **20**A (e.g., due to bending or rotation of housing portions **8**A and **8**B). For example, control circuitry **16** may determine whether distortions associated with changes in relative position are present in the image data. If compensation is needed, control circuitry **16** may control display module **20**A to compensate for these changes. For example, control circuitry **16** may adjust the position and/or geometry of optical components within display module **20**A, may adjust the brightness/intensity of input light **56**, may adjust the color of input light **56**, and/or may perform any other desired adjustments to display module **20**A that compensate for distortions in beam **55** on account of the change in relative position between combiner **40** and display module **20**A. If no compensation is needed, adjustments to display module **20**A may be omitted. Processing may subsequently loop back to step **250** as shown by arrow **258**.

[0099] In this way, system **10** may perform active feedback on the projected images to compensate for changes in the position of housing portion **8**A relative to the position of housing portion **8**B over time (e.g., using image data indicative of the user's perspective at eye box **24**). This may help to ensure that images having a uniform and non-distorted perspective are provided to eye box **24** over time.

[0100] Display module **20**A as described herein may include any desired displays or light projection components. As examples, display module **20**A may include spatial light modulators, liquid crystal displays, organic light-emitting diode displays, laser-based displays, microelectromechanical system (MEMS)-based displays, digital micromirror device (DMD) displays, liquid crystal on silicon (LCoS) displays, computer-generated holography (CGH) displays, or displays of other types. If desired, optical components may be provided for directing light from display module **20**A onto multi-layer holographic combiner **40**.

[0101] If desired, display module **20**A may be configured to project light using foveation techniques. In these scenarios, the display module may display images in which a central portion of the displayed image is provided at higher resolution than peripheral portions of the displayed image. This may, for example, mimic the natural response of the user's eye such that the displayed images still appear naturally to the user while also reducing the resources and data rate required to display the images.

[0102] FIG. **20** is a diagram showing how a waveguide may be used to direct and expand light (entrance pupils) from display module **20**A onto multi-layer holographic combiner **40**. As shown in FIG. **20**, display module **20**A may generate a relatively narrow beam of image light **260**. Optical system **20**B may include optical components **262** for redirecting and expanding beam **260** onto multi-layer holographic combiner **40**.

[0103] Optical components **262** may include a waveguide such as waveguide **270**. Waveguide **270** may be provided with an input coupler such as input coupling prism **272** mounted to surface **278** of waveguide **270**. This is merely illustrative and, in general, any desired input couplers may be used. Prism **272** may couple beam **260** into waveguide **270**. The light from beam **260** may propagate down the length of waveguide **270** between surfaces **276** and **278** under the principle of total internal reflection (as show by arrows **274**). Some of the light may be coupled out of waveguide **270** at multiple points as the light propagates down the length of waveguide **270** (e.g., at each point where the light hits surface **276**, using output couplers on surface **276**, output couplers on surface **278**, and/or output couplers embedded within waveguide **270**, etc.). This may serve to expand the relatively narrow beam **260** into expanded beam **264**. Optical components **262** may include optical elements **268** (e.g., one or more lenses) that provide expanded beam **264** with a desired optical power and that focus expanded beam **264** onto multi-layer holographic combiner **40**, as shown by beam **266**. Multi-layer holographic combiner **40** may replicate beam **266** and may focus the replicated beams onto the eye box (e.g., beam **266** may form input light **56** of FIGS. **2-4**, **8**, **12**, and **18**). When configured in this way, the pupils provided to eye box **24** (e.g., based on beam **266**) may be expanded relative to scenarios where optical components **262** are omitted. The example of FIG. **20** is merely illustrative and, in general, optical components **262** may include any desired optical elements.

[0104] In another suitable arrangement, if desired, multi-layer holographic combiner **40** may include multiple transmission hologram structures. FIG. **21** is a diagram showing how multi-layer holographic combiner **40** may include multiple transmission hologram structures. As shown in FIG. **21**, multi-layer holographic combiner **40** may include transmission hologram structures **44** and additional transmission hologram structures **304**. In the example of FIG. **21**, additional transmission hologram structures **304** are layered under transmission hologram structures **44**. If desired, additional transmission hologram structures **304** may be layered on the opposing side of transmission hologram structures **44** (e.g., over transmission hologram structures **44**), as shown by dashed box **306**. In yet another suitable arrangement, additional transmission hologram structures **304** may be formed from the same holographic structures as transmission hologram structures **44** (e.g., structures **304** and **44** may be formed from superimposed holograms recorded within the same volume of holographic medium).

[0105] Transmission hologram structures **44** may replicate input light **56**, as shown by replicated light **300**. Multi-layer holographic combiner **40** may include a partially reflective structure **310** that reflects replicated light **300** towards additional transmission hologram structures **304**, as shown by reflected replicated light **302**. Additional transmission hologram structures **304** may focus reflected replicated light **302** onto eye box **24** (FIG. **2**). This may serve to advantageously double the path length for image replication by multi-layer holographic combiner **40**. Partially reflective structure **310** may include a half-silvered mirror, reflective coatings, a reflective holographic optical element, a filter such as a notch filter (e.g., a thin film interference filter that reflects light over a relatively narrow band of wavelengths), or other reflective structures.

[0106] The example of FIGS. **2-21** in which multi-layer holographic combiner **40** is described as being used to combine virtual and real-world images is merely illustrative. In general, multi-layer holographic combiner **40** may redi-